Patent Claims

1. Process for the synthesis of a liquid melamine resin, characterized in that

a) melamine, at least one aldehyde and at least one alcohol are fed to a continuous first reaction stage (100) which has in particular at least one stirred vessel and are reacted therein,

b) the reaction mixture, in particular a suspension, is fed to a solid-liquid phase separation apparatus (11) for separation into a solids-rich phase (A) and a solids-poor phase (B),

c) the solids-rich phase (A) present after the solid-liquid phase separation is recycled to the first reaction stage (100) and

d) the solids-poor phase (B) present after the solid-liquid phase separation is fed to further processing steps, in particular transported to a second reaction stage (200) and further reacted there.

2. Process according to Claim 1, characterized in that the solids-rich phase (A) is rich in undissolved melamine.

3. Process according to Claim 1 or 2, characterized in that the reaction product is taken off as a suspension from an overflow of a reactor of the first reaction stage (100), in particular of the last reactor of the first reaction stage (100), and transported into the solid-liquid phase separation apparatus (11).

4. Process according to at least one of the preceding claims, characterized in that the solid-liquid phase separation apparatus (11) is in the form of a hydrocyclone, in the form of a centrifuge, in particular in the form of a disc centrifuge, or in the form of a filter.

5. Process according to at least one of the preceding claims, characterized in that at least one alcohol methanol is used and at least one aldehyde a solution of formaldehyde (37% strength) in water and methanol is used.

6. Process according to Claim 6, characterized in that the reactants are homogeneously premixed in a continuous mixer (6) before the first reaction stage (100).

7. Process according to at least one of the preceding claims, characterized in that the reaction takes place in at least one reactor (10) of the first reaction stage (100) at temperatures between 70 and 140°C and at a pressure between 2 and 30 bar.

8. Process according to at least one of the preceding claims, characterized in that, after the solid-liquid phase separation apparatus (11), the solids-poor phase (B) is fed to at least one continuous second reaction stage (200), in particular having at least one tubular reactor for further etherification.

9. Process according to Claim 8, characterized in that the reaction in the second reaction stage (200) is carried out under acidic conditions, in particular at a pH between 5 and 6.

10. Process according to Claim 8 or 9, characterized in that the second reaction stage (200) is carried

out in the presence

of heterogeneous acidic catalysts, such as, for example, acidic ion exchangers.

11. Process according to at least one of Claims 8 to 10, characterized in that at least one reactor (20) of the second reaction stage (200) has mixing elements, in particular static mixers and/or packings.

12. Process according to at least one of Claims 8 to 11, characterized in that homogeneous catalysts are mixed with the reaction mixture before the second reaction stage (200).

13. Process according to at least one of Claims 8 to 12, characterized in that, after the second reaction stage (200), a pH of more than 9 is established, in particular by metering in (21) sodium hydroxide solution.

14. Process according to at least one of Claims 8 to 13, characterized in that the reaction product of at least one second reactor (20) in alcoholic solution is concentrated in at least one evaporation step (25), C_4-C_{18}-alcohols, diols of the type HO-R-OH and/or tetrahydric alcohols based on erythritol being added to the melamine resin precondensate before, during and/or after the concentration and the concentrated melamine resin precondensate being reacted in a third reaction stage (300) by means of a mixer (30), in particular a kneader.

15. Process according to Claim 14, characterized in that at least one diol of the type HO-R-OH having molar masses of 62 to 20 000 or a mixture of at least two diols of the type HO-R-OH having molar masses of 62 to 20 000 are used, it being possible for the substituent R to have one of the following structures

C_2-C_{18}-alkylene,

-CH(CH_3)-CH_2-O-(C_2-C_{12})-alkylene-O-CH_2-CH(CH_3)-,

-CH(CH_3)-CH_2-O-(C_2-C_{12})-arylene-O-CH_2-CH(CH_3)-,

-(CH_2-CH_2-CH_2-CH_2-CH_2-CO)$_x$-(CH_2-CHR)$_y$-,

-[CH_2-CH_2-O-CH_2-CH_2]$_n$-,

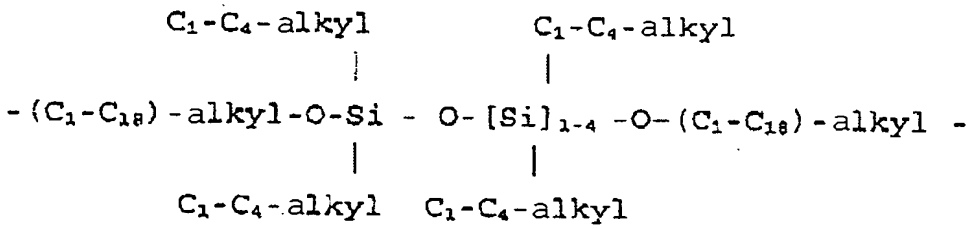
-[CH_2-CH(CH_3)-O-CH_2-CH(CH_3)]$_n$-,

-[O-CH_2-CH_2-CH_2-CH_2]$_n$-,

-[(CH_2)$_{2-8}$-O-CO-(C_6-C_{14})-arylene-CO-O-(CH_2)$_{2-8}$]$_n$-,

-[(CH_2)$_{2-8}$-O-CO-(C_2-C_{12})-alkylene-CO-O-(CH_2)$_{2-8}$]$_n$-,

in which n = 1 to 200; x = 5 to 15;



- polyester sequences containing siloxane groups and of the type

-[(X)$_r$-O-CO-(Y)$_s$-CO-O-(X)$_r$]-,

in which

X = -{(CH_2)$_{2-8}$-O-CO-(C_6-C_{14})-arylene-CO-O-(CH_2)$_{2-8}$}-

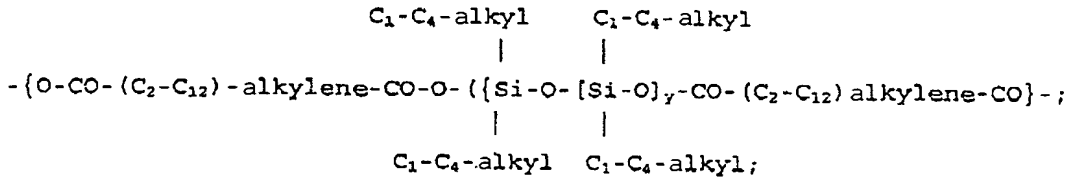
or

-{(CH_2)$_{2-8}$-O-CO-(C_2-C_{12})-alkylene-CO-O-(CH_2)$_{2-8}$}-;

$$Y = -\{(C_6\text{-}C_{14})\text{-arylene-CO-O-}(\{Si\text{-}O\text{-}[Si\text{-}O]_y\text{-CO-}(C_6\text{-}C_{14})\text{arylene}\}\text{-}$$

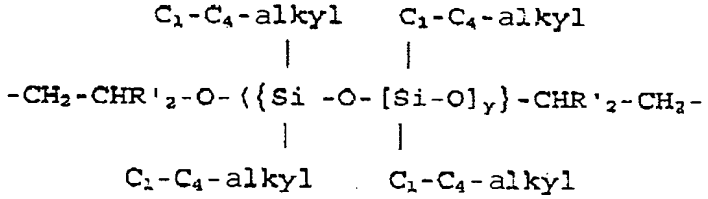
$$\begin{matrix} & & | & & | & \\ & & C_1\text{-}C_4\text{-alkyl} & & C_1\text{-}C_4\text{-alkyl} & \end{matrix}$$

or



in which r denotes 1 to 70; s denotes 1 to 70 and y denotes 3 to 50;

- polyether sequences containing siloxane groups and of the type



in which R'_2 denotes H; C_1-C_4-alkyl and y denotes 3 to 50;

- sequences based on alkylene oxide adducts of melamine of the type 2-amino-4,6-di(C_2-C_4)alkyleneamino-1,3,5-triazine sequences

- phenol ether sequences based on dihydric phenols and C_2-C_8-diols of the type -(C_2-C_8)alkylene-O-(C_6-C_{18})-arylene-O-(C_2-C_8)-alkylene sequences.

16. Process according to Claim 14 or 15, characterized in that the etherified melamine resin condensates are mixtures having average molar masses of 500 to 2500 and comprising tris(methoxymethylamino)-triazine and higher molecular weight oligomers thereof.

17. Process according to at least one of Claims 14 to 16, characterized in that, before and/or during the concentration, i.e. before the first and/or before the second evaporator stage, and/or after the concentration, i.e. before the second reaction stage (200), acids and/or acid anhydrides dissolved in alcohol or water are added to the melamine resin precondensate.

18. Process according to at least one of Claims 14 to 17, characterized in that the concentrated melamine resin precondensate obtained after the evaporation has a concentration of 95 to 99% by weight.

19. Process according to at least one of Claims 14 to 18, characterized in that the evaporation of the low molecular weight components is effected in two stages.

20. Process according to at least one of Claims 14 to 18, characterized in that the kneader (30) is in the form of a continuously operating extruder which is at least partly self-purging and has vacuum devolatilization.

21. Process according to at least one of Claims 14 to 18, characterized in that the kneader (30) used is a twin-screw extruder having devolatilization zones.

22. Process according to at least one of Claims 14 to

19, characterized in that, in the continuous kneader (30), additionally up to 75% by mass of fillers and/or reinforcing fibres, further reactive polymers of the type

consisting of ethylene copolymers, maleic anhydride copolymers, modified maleic anhydride copolymers, poly(meth)acrylates, polyamides, polyesters and/or polyurethanes, and up to 2% by mass, based in each case on the etherified melamine resin condensates, of stabilizers, UV absorbers and/or auxiliaries are incorporated.

23. Process according to at least one of Claims 14 to 22, characterized in that the melamine resin condensate is discharged and granulated after a third reaction stage (300).

24. Use of etherified melamine resin condensates, prepared by a process according to at least one of Claims 1 to 24, for melt processing, in particular as hotmelt adhesives, and for the production of sheets, tubes, profiles, injection moulded parts, fibres, coatings and foams, or for processing from solution or dispersion as an adhesive, impregnating resin, coating resin or laminating resin, or for the production of foams, microcapsules or fibres.

25. Melamine resin products produced by means of a melamine resin condensate etherified by a direct synthesis process according to at least one of Claims 1 to 23.